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PROVISIONAL APPLICATION FOR PATENT COVER SHEET

This is a request for filing a PROVISIONAL APPLICATION FOR PATENT under 37 CFR 1.53 (c).

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INVENTOR(S)		
Given Name (first and middle [if any])	Family Name or Surname	Residence (City and either State or Foreign Country)
SHAILY CHARLES CHUANMING	VERMA WANG	MONMOUTH JUNCTION, NJ JAMISON, PA

☐ *Additional inventors are being named on the _____ separately numbered sheets attached hereto*

TITLE OF THE INVENTION (280 characters max)

WLAN AS A LOGICAL SGSN FOR WLAN-UMTS INTERWORKING

CORRESPONDENCE ADDRESS

Direct all correspondence to:

☐ Customer Number [ ] → *Place Customer Number Bar Code Label here*

OR *Type Customer Number here*

☒ Firm *or* Individual Name	JOSEPH S. TRIPOLI, THOMSON MULTIMEDIA LICENSING INC.				
Address	PATENT OPERATIONS.				
Address	P. O. BOX 5312				
City	PRINCETON	State	NJ	ZIP	08543-5312
Country	USA	Telephone	609-734-9444	Fax	609-734-9700

ENCLOSED APPLICATION PARTS *(check all that apply)*

☒ Specification *Number of Pages* 6 ☐ CD(s), Number [ ]

☐ Drawing(s) *Number of Sheets* [ ] ☐ Other (specify) [ ]

☐ Application Data Sheet. See 37 CFR 1.76

METHOD OF PAYMENT OF FILING FEES FOR THIS PROVISIONAL APPLICATION FOR PATENT *(check one)*

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☐ Yes, the name of the U.S. Government agency and the Government contract number are: _____.

Respectfully submitted,

SIGNATURE [signature] Date 6/6/02

TYPED or PRINTED NAME PAUL P. KIEL REGISTRATION NO. *(if appropriate)* 40,677

TELEPHONE 609 734-9650 Docket Number: PU020268

USE ONLY FOR FILING A PROVISIONAL APPLICATION FOR PATENT

WLAN as a logical SGSN for WLAN-UMTS interworking.

The drawback of the UMTS (Universal Mobile Telecommunications System) network is high cost of spectrum and low data rates as compared to WLANs (Wireless Local Area Networks). It is thus advantageous to complement UMTS with unlicensed band, high data rate WLANS such as IEEE 802.11 and ETSI Hiperlan2 in order to save UMTS radio resources and increase the efficiency of the UMTS RAN (Radio Access Network). The invention proposes an architecture where the WLAN interacts with the UMTS network through the intra-PLMN backbone over the Gn interface.

A number of architectures are possible to interwork between the WLAN coverage area and other radio access technologies (RATs) such as UMTS. However here a novel approach is presented as it helps to complement the UMTS network by including the WLAN gateway in the intra-PLMN backbone. The advantage is that the QOS negotiation, mobility, AAA procedures of the 3G network are completely re-used and the 3G operator retains tight control over his customer base. The ideas in this invention can work with any system (GPRS/CDMA 2000) that needs to interwork with WLANs.

References

Ref [1] 3GPP TS 25.401: "UTRAN Overall Description".

Ref [2]: 3GPP TS 23.060: "General Packet Radio Service (GPRS), Service description, Stage 2".

Ref [3]: 3GPP TS 24.008: "Mobile radio interface layer 3 specification Core Network Protocols Stage 3".

Ref [4]: 3GPP TS 25.331: "RRC Protocol Specification".

Ref [5]: 3GPP TS 25.133: "Requirements for Support of Radio Resource Management (FDD)".

Ref [6]: 3G TS 23.003: "Numbering, addressing and identification".

Ref [7]: Thomson Multimedia Disclosure-" Registration of the WLAN as a UMTS routing area for WLAN - UMTS interworking", Shaily Verma, Charlie Wang.

Acronyms

BG	Border Gateways
CN	Core Network
GGSN	Gateway GPRS Support Node
GPRS	General Package Radio Service
GSN	Gateway Support Node
GTP	GPRS Tunneling Protocol
GTP-U	GPRS Tunneling Protocol-User plane
PLMN	Public Land Mobile Network
PMM	Packet Mobility Management
RA	Routing Area
RAI	Routing Area Identifier
RAN	Radio Access Network
RAT	Radio Access Technology

RAU	Routing Area Update
RNC	Radio Network Controller
SGSN	Serving GPRS Support Node
UMTS	Universal Mobile Telecommunications System
WLAN	Wireless Local Area Network

UMTS - WLAN interworking architecture

The context of the present invention is the UMTS and WLAN (802.11(a, b, e, g) and HIPERLAN2) wireless network. The 3G UMTS mobile communicates with the radio access network (RAN) comprising of the Node B and Radio Network Controller (RNC). The RAN in turn is attached to the Core Network (CN) comprising of the SGSN (packet based services), MSC (circuit based services) and GGSN (gateway to other PLMNs).

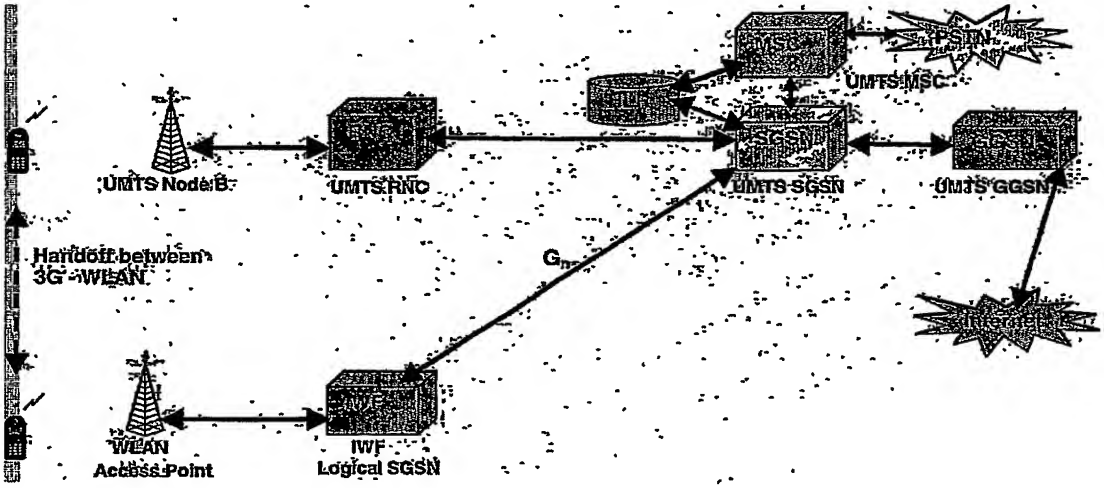

Figure 1: Tight coupling model for WLAN-3G interworking (logical SGSN)

In Figure 1, the WLAN interworking function (IWF) bypasses the RNC and connects to the SGSN (assuming PS services). The GGSN takes care of the mobility at the IP layer, but the IWF will need to communicate with the SGSN to provide the mobility for the handoff between the two physical layer interfaces. This can be achieved by implementing the Gn interface between the IWF and the SGSN as shown in Figure 2 and 3. The 3G SGSN then sees the IWF as a logical SGSN.

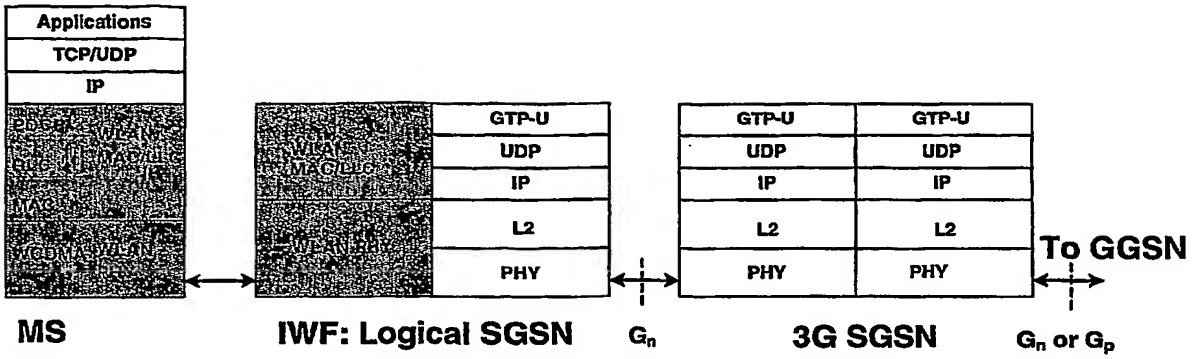

Figure 2: User plane stack for IWF as Logical SGSN

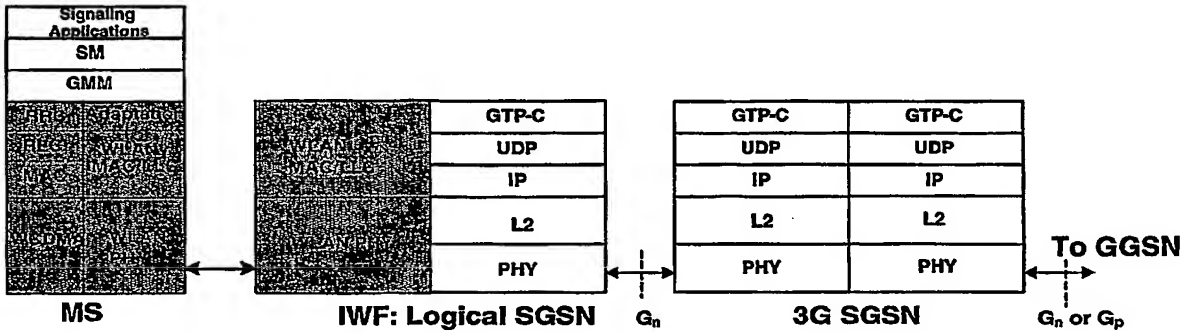

Figure 3: Control plane stack for IWF as Logical SGSN

The SGSN-GGSN part may become a bottleneck in handling high data rate WLAN hotspots. In that case another option is that the GTP tunnel between GGSN and IWF is used only for downlink traffic coming at the GGSN for the UE. For all other traffic, the WLAN provides a common Internet access to the UE. This shall keep the traffic through the SGSN-GGSN lower.

Mobility

1. UMTS to WLAN Entry

We assume that the terminal can detect the entry into a WLAN. If the UMTS SGSN covers one RA and the WLAN coverage area is another RA, as per [7], the WLAN IWF can broadcast the new RAI (pre-allocated by the UMTS network) or send it at the time the UE registers with the WLAN. By comparing the RAI stored in the UE's GMM context with the RAI received from the IWF, the UE detects that an RA update (inter-SGSN) needs to be performed. The procedure is described in [2] and is shown in Figure 4. For an Inter-SGSN RA Update, the new SGSN (IWF) typically informs the HLR of the change of SGSN by sending Update Location (SGSN Number, SGSN Address, and IMSI) to the HLR. Three scenarios are possible:

Case 1: The IWF can have the Gr interface with the HLR in which case all the steps in Figure 4 as per [2] can be followed.

Case 2: The new SGSN (IWF) shall not implement the Gr interface towards HLR and so step 6 of sending location update to the HLR by the IWF along with steps 7, 8, 9, 10, 11,12, 15 shall be skipped. The Iu release sequence in 7a shall happen when the UE sends an explicit signaling

connection release to the UTRAN upon being validated by the old SGSN in step 2 or 2a depending on the PMM state of the UE. Since the GGSN is updated with the new SGSN (IWF) the UE is now registered with in step 5, all the uplink and downlink packets shall be sent conveniently and the skipping of HLR location update shall not cause any problems.

Case 3: IP based Diameter authentication from the HSS may be implemented between an IWF and HLR in the future and standard procedures for inter-SGSN relocation can transpire.

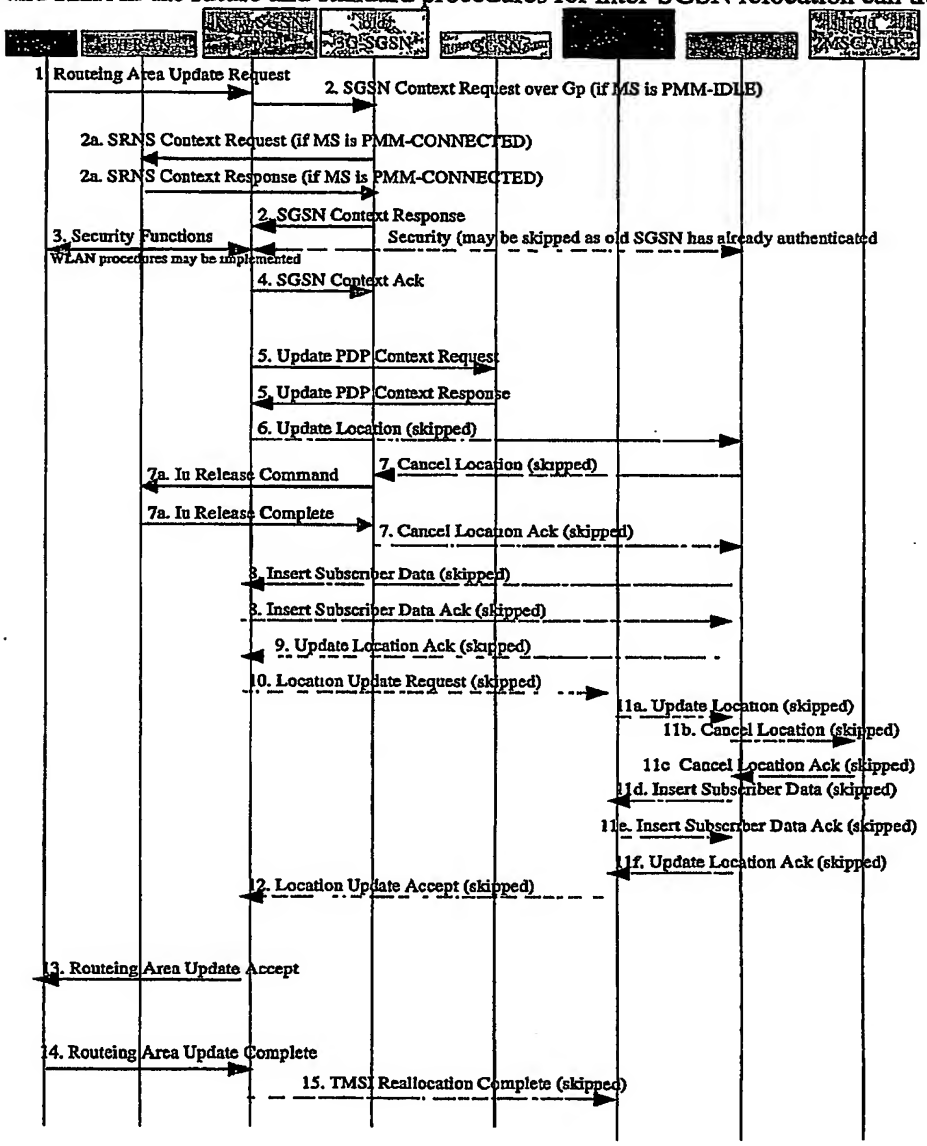

Figure 4: Routing area change from UMTS SGSN to IWF (pseudo SGSN)

2. WLAN to UMTS Entry

Upon re-entry into the UMTS network the UE shall again perform an inter-SGSN routing area update and repeat the procedures shown in Figure 4 except that this time the new SGSN shall be the UMTS SGSN while the old SGSN shall be the IWF. 3G security procedures should be implemented to re-validate the UE when it goes back to the UMTS network.

Again the three cases mentioned above are valid:

Case 1: The IWF can have the Gr interface with the HLR in which case all the steps in Figure 4 as per [2] can be followed.

Case 2: Since while going into the WLAN, the IWF had not updated the HLR and the UMTS SGSN marked in its context that the MSC/VLR association and the information in the GGSNs and the HLR as invalid, when the MS initiates a routing area update procedure back to the UMTS SGSN, it triggers the MSC/VLR, the GGSNs, and the HLR information in the UMTS SGSN to be updated/validated.

Case 3: IP based Diameter authentication from the HSS may be implemented between an IWF and HLR in the future and standard procedures for inter-SGSN relocation can transpire.

Security

The IWF will implement 3G procedures to authenticate the UE. In step 2 in Figure 4, if the MS was in PMM-IDLE state, the IWF (new SGSN) sends an SGSN Context Request message (old P-TMSI, old RAI, old P-TMSI Signature) to the old SGSN to get the MM and PDP contexts for the MS. The old SGSN validates the old P-TMSI Signature and responds with an appropriate error cause if it does not match the value stored in the old SGSN. The IWF can be attached to the 3G intra-PLMN backbone and so need not re-authenticate the UE with the HLR upon it's entering the WLAN if the old SGSN validates the UE. The UE in PMM-CONNECTED state entails the sending of a Relocation Command message to the source SRNC by the old SGSN followed by a Forward SRNS Context (RAB Contexts) message to the new SGSN (IWF) via the old SGSN, which is again a validation of the UE by the UMTS SGSN.

However WLAN security procedures should be implemented so that the MS sends ciphered P-TMSI, old RAI, old P-TMSI Signature, Update Type, follow on request, Classmark, DRX Parameters and MS Network Capability to the IWF (new SGSN), which can then send them to the old 3G SGSN.

Advantage of the invention

The advantages of the invention are the following:

- The advantage is that the mobility, AAA procedures of the 3G network are re-used.
- The service provider requires only one point of attachment to serve the 3G network as well as the attached WLANs helping him retain tight control over his customer base in the WLAN as well.
- The simple IP-based Gn interface of the SGSN shall be implemented in the IWF towards the SGSN making the solution scalable. As proposed in case 2 under the section on mobility, the other complex SGSN interfaces such as Gr (towards HLR) etc. can be skipped.

- Address is still allocated by the same GGSN while the terminal is in the WLAN.
- The proposed solution also has the advantage that the dual GTP encapsulation as in the UMTS network (GGSN-SGSN and then SGSN-RNC) is avoided as only the GGSN-IWF encapsulation part is done in the WLAN coverage area.
- No modifications to the existing UMTS network nodes are required for this interworking architecture.
- Using the concept in [7], the RA update timer can be set to a large value upon entering the WLAN RA so that frequent RAUs are avoided resulting in conservation of battery.
- WLAN radio resources shall be used in the WLAN coverage area freeing up the radio resources of the RAT (3G) the UE is moving into the WLAN from.